

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
14 June 2001 (14.06.2001)

(10) International Publication Number
WO 01/42617 A1

PCT

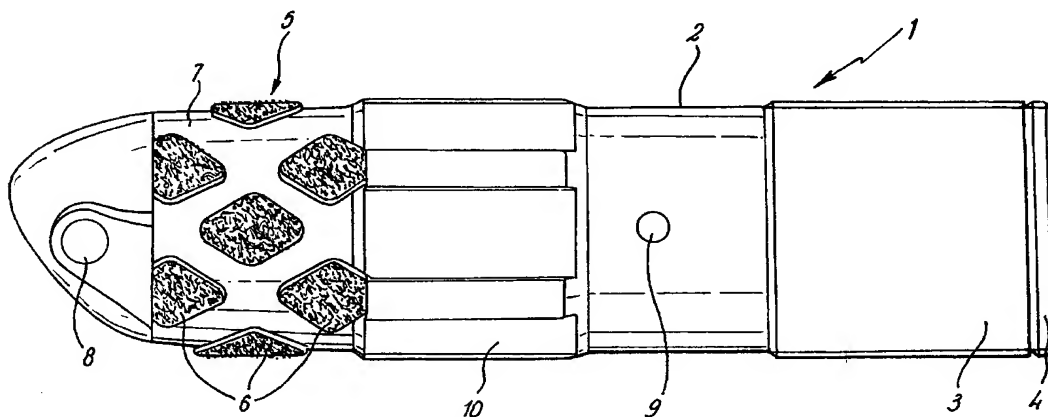
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|---|---|--|
| (51) International Patent Classification⁷: | E21B 17/14 | (81) Designated States (<i>national</i>): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EE, EE (utility model), ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW. |
| (21) International Application Number: | PCT/GB00/04704 | |
| (22) International Filing Date: | 11 December 2000 (11.12.2000) | |
| (25) Filing Language: | English | |
| (26) Publication Language: | English | (84) Designated States (<i>regional</i>): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). |
| (30) Priority Data: | 9929000.9 9 December 1999 (09.12.1999) GB | |
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— <i>With international search report.</i> |
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Published:

— *With international search report.*

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(54) Title: REAMER SHOE



(S7) Abstract: A reamer shoe (1) for mounting on a tubing string has a reaming area (5) supporting a plurality of discrete reaming members (6) typically formed as simple geometrical shapes. The reaming members provide complete circumferential coverage of the shoe body (2) but the individual reaming members are non-continuous and do not fully extend either longitudinally along or circumferentially around the reaming area on the shoe body. The invention therefore provides a reamer shoe for reaming a bore in preparation for receiving casing, which is effective on rotation or reciprocation, regardless of direction or speed.

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1 **Reamer Shoe**

2

3 The present invention relates to a reamer shoe for use in
4 drilled well bores as are typically utilised in oil and
5 gas production.

6

7 After boring a region of an oil or gas well it is normal
8 to run tubing or "casing", into the well bore to act as a
9 lining. The casing is typically run into the well bore
10 from the surface and the length of casing is often
11 referred to as a "casing string". The lining of the bore
12 can then be strengthened by introducing cement between
13 the external surface of the casing and the internal
14 surface of the well bore.

15

16 It is common for the casing to meet obstructions as it is
17 run through the well bore. These may be ledges which
18 form in the well bore material during boring, formation
19 washouts, or debris formed by unstable sections of the
20 well bore wall collapsing. Such obstructions halt the
21 progress of the casing procedure and increase the risk of
22 the casing string jamming in the bore. To prevent or
23 minimise the effect of these obstructions a reamer shoe

1 is conventionally mounted on the lower end of the casing
2 string. The reamer shoe typically has a plurality of
3 reaming members around the circumference of the shoe
4 body, which remove any irregularities or obstructions
5 from the wall of the bore and thereby facilitate the
6 subsequent passage of the casing string and aid
7 cementing.

8
9 In conventional reamer shoes, the reaming members extend
10 parallel to the length of the shoe. Whilst this
11 arrangement allows the reaming members to come into
12 contact with the entire circumference of the bore well on
13 rotation of the shoe, complete circumferential coverage
14 of the bore well is not achieved when the shoe is
15 reciprocated.

16
17 An attempt has been made to mitigate this problem in
18 International Patent Application PCT/GB99/00093 in the
19 name Downhole Products plc. This Application discloses a
20 reamer shoe with reaming members which extend
21 longitudinally and helically around, as opposed to
22 longitudinally and parallel to, the shoe body. More
23 specifically the reaming members extend helically around
24 the body of the shoe in an opposite direction to the
25 intended direction of rotation.

26
27 While this arrangement of reaming members gives full 360°
28 coverage during both reciprocating and rotation, the
29 efficiency of said members is very much dependent on the
30 speed and also the direction of rotation. It will be
31 appreciated that the quality of reaming action will be
32 compromised at relatively high rotational speeds. In
33 addition, the reaming action of the shoe is designed to

1 be most efficient when the reaming members extend in the
2 opposite direction to rotation; therefore if the shoe was
3 rotated in the same direction as the reaming members
4 extend, either intentionally or accidentally, the risk of
5 the reaming members "biting" into the wall and hence
6 becoming stuck in the bore would be increased. It would
7 therefore be a distinct advantage to provide a reamer
8 shoe which is equally effective on rotation and
9 reciprocation, and which provides an efficient reaming
10 action regardless of the speed and direction of rotation.
11

12 It is an object of the present invention to provide a
13 reamer shoe for reaming a bore in preparation for
14 receiving casing, wherein said reaming shoe is equally
15 effective on rotation or reciprocation.
16

17 It is a further object of the present invention to
18 provide a reamer shoe for reaming a bore in preparation
19 for receiving casing, wherein said reaming shoe is
20 efficient at cleaning a bore when rotated, regardless of
21 the speed or direction of rotation.
22

23 It is a yet further object of the present invention to
24 provide a reamer shoe for reaming a bore in preparation
25 for receiving casing, which is effective on rotation or
26 reciprocation, regardless of direction or speed, and
27 which is capable of covering the full 360° circumference
28 of the bore.
29

30 According to the present invention there is provided a
31 reamer shoe for mounting on a tubing string, the reamer
32 shoe having a reaming area supporting a plurality of
33 reaming members with each of the reaming members being

1 afforded a simple geometric shape, wherein the plurality
2 of reaming members have complete circumferential coverage
3 of the shoe body but the individual reaming members are
4 non-continuous and do not fully extend either
5 longitudinally along or circumferentially around the
6 reaming area on the shoe body.

7
8 Optionally the reaming members are diamond shaped.

9
10 Alternatively the reaming members are square or circular
11 although any other simple geometrical shape may be
12 employed.

13
14 Preferably the reaming members are shaped in such a
15 manner that they are separated by void areas which permit
16 the relative by pass of fluid over the reaming area,
17 between the reaming members.

18
19 Preferably the reamer shoe has a plurality of flow by
20 areas or flow ports to allow lubrication of the shoe.

21
22 Preferably the reaming members are made of a hard wearing
23 and resistant material such as tungsten carbide or
24 polycrystalline diamond, although any other suitable
25 material may be used.

26
27 Preferably the reaming members are securely attached to
28 the shoe body by a standard technique such as welding or
29 mechanical locking although any other suitable fixing
30 means could be used.

31
32 Preferably the reamer shoe has connection means for
33 mounting the reamer shoe on a tubing string.

1
2 Most preferably said connection means are threaded end
3 connections which can mate with corresponding connection
4 means on the casing.

5
6 Preferably the reaming shoe has an internal diameter
7 which is at least equal to, or greater than the internal
8 diameter of the casing.

9
10 Preferably the reamer shoe comprises a stabiliser or
11 centraliser.

12
13 Preferably the dimensions of the reamer shoe are not
14 restricted and could be adapted to be suitable for use
15 with any casing equipment.

16
17 An example embodiment of the invention will now be
18 illustrated with reference to Figure 1 which illustrates
19 a reamer shoe in accordance with the present invention.

20
21 Referring to Figure 1 a reamer shoe, generally depicted
22 at 1, is comprised of a cylindrical body 2 which can be
23 mounted on the lower end of a casing string (not shown).
24 Typically mounting is achieved using threaded end
25 connections 3 and a respective fit thread protector 4
26 located at the rear of the body 2 which mate with the
27 casing.

28
29 The reamer shoe 1 further comprises a reaming area 5
30 which supports a plurality of reaming members 6. The
31 reaming members 6 are constructed from a hard resistant
32 material such as polycrystalline diamond compact or
33 tungsten carbide, or a combination of the two materials.

1 The reaming members 6 do not fully extend either
2 longitudinally along or circumferentially around the
3 reaming area 5 on the shoe body 2 that is, they are non
4 continuous, and are afforded a diamond shape in the
5 present embodiment, although this is not restricted and
6 any other geometrical shape such as circles or squares
7 could be employed.

8
9 As the reaming members 6 are non-continuous, each
10 individual member is separated from the surrounding
11 reaming member by void space 7. This void space 7
12 functions to allow the by-pass of fluid which is passed
13 through the bore well (not shown) over the reaming area
14 5. The body 2 also has an additional flow by area 8 and
15 flow port 9 to allow fluid by pass to lubricate the
16 surfaces of the reaming shoe 1. The body 2 also
17 comprises a stabiliser or centraliser 10 which functions
18 to maintain the reaming shoe 1 in the centre of the well
19 bore (not shown).

20
21 In use, the reamer shoe 1 is mounted on the casing string
22 (not shown) relatively close to the first section of the
23 string. Upon reaching an obstruction or irregularity in
24 the bore wall the tool may be reciprocated or rotated as
25 required, in order to remove or push aside the
26 obstruction in preparation for receiving casing. The
27 casing operation can then be continued.

28
29 The present invention is inherent with significant
30 advantages in that the geometrical design of the reaming
31 members increases the efficiency of the reaming process
32 regardless of whether the shoe is rotated or
33 reciprocated. The tendency to "bite" into the wall of

1 the bore and become stuck, which is often seen with
2 conventional reaming blades which extend around the body
3 of the shoe, is minimised.

4

5 A further advantage is that, unlike the reaming members
6 known to the art, which conventionally extend parallel to
7 or helically around the reamer shoe, the reaming members
8 of the present invention are geometric and non
9 continuous, and therefore have no direction as such. On
10 rotation, the reaming members of the present invention
11 are therefore effective regardless of whether the shoe is
12 rotated in a clockwise or anti-clockwise direction.

13

14 Further modifications and improvements may be
15 incorporated without departing from the scope of the
16 invention herein intended.

Claims:

1. A reamer shoe for mounting on a tubing string, the reamer shoe having a reaming area supporting a plurality of discrete reaming members, wherein the plurality of reaming members have complete circumferential coverage of the shoe body but the individual reaming members are non-continuous and do not fully extend either longitudinally along or circumferentially around the reaming area on the shoe body.
2. A reamer shoe as claimed in Claim 1 wherein the reaming members are diamond shaped.
3. A reamer shoe as claimed in Claim 1 wherein the reaming members are formed as discrete simple geometrical shapes.
4. A reamer shoe as claimed in any one of the preceding Claims wherein the reaming members are separated by void areas which permit by pass of fluid over the reaming area, between the reaming members.
5. A reamer shoe as claimed in any one of the preceding Claims having a plurality of flow by areas or flow ports to allow lubrication of the shoe.
6. A reamer shoe as claimed in any one of the preceding Claims wherein the reaming members are made of a hard wearing and resistant material, such as tungsten carbide or polycrystalline diamond.

- 1 7. A reamer shoe as claimed in any one of the preceding
2 Claims wherein the reaming members are securely
3 attached to the shoe body by a welding process.
4
- 5 8. A reamer shoe as claimed in any one of the preceding
6 Claims 1 to 6 wherein the reaming members are
7 securely attached to the shoe body by a mechanical
8 locking technique.
9
- 10 9. A reamer shoe as claimed in any one of the preceding
11 Claims having connection means for mounting the
12 reamer shoe on a tubing string.
13
- 14 10. A reamer shoe as claimed in any one of the preceding
15 Claims having an internal diameter which is at least
16 equal to, or greater than the internal diameter of
17 the casing.
18
- 19 11. A reamer shoe as claimed in any one of the preceding
20 Claims further comprising a stabiliser or
21 centraliser.
22

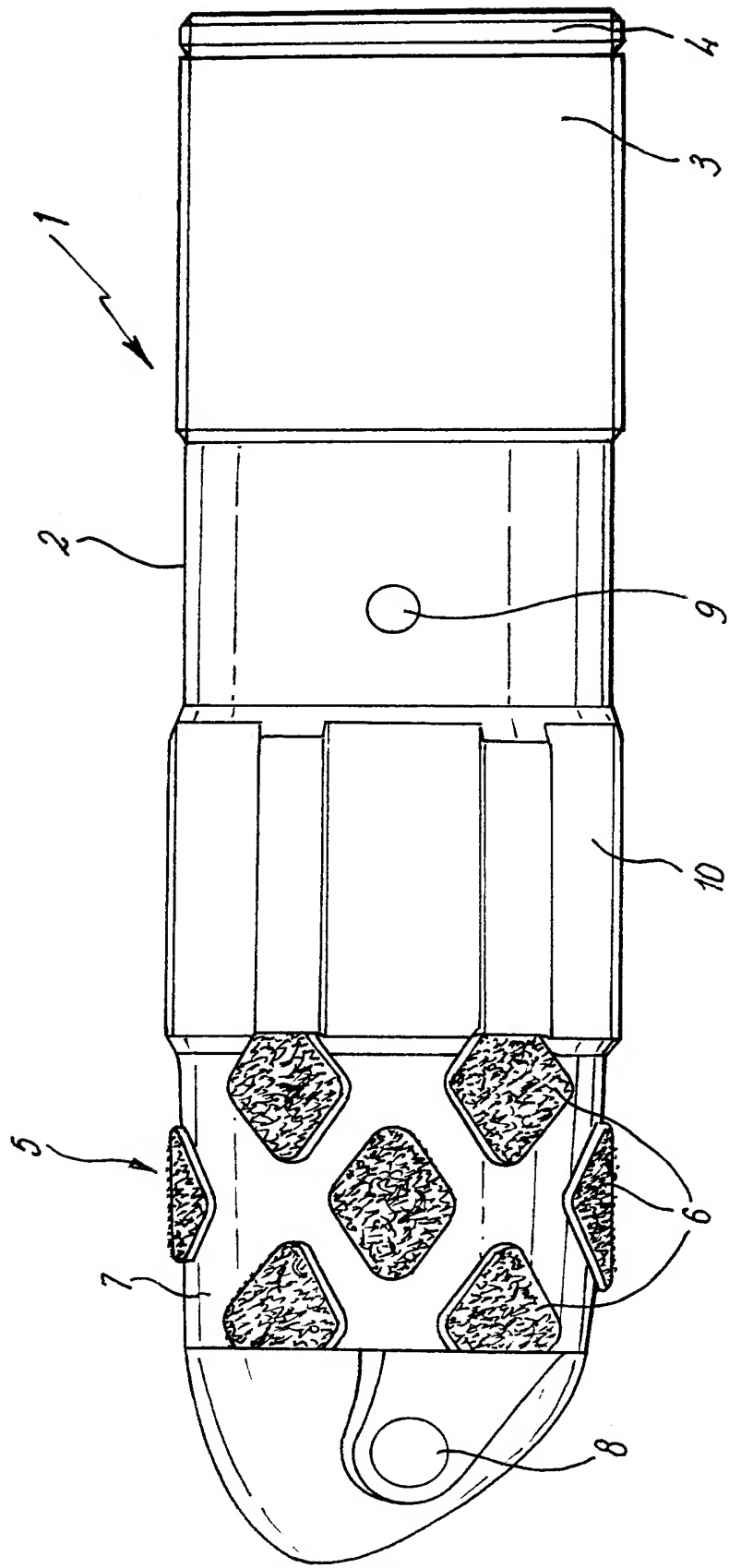


Fig. 1

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/04704

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 E21B17/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data, TULSA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	WO 99 37881 A (DOWNHOLE PRODUCTS PLC ;KIRK IAN ALASTAIR (GB); BARRON WILLIAM (GB)) 29 July 1999 (1999-07-29) cited in the application page 2, line 26 -page 3, line 17; claim 1; figures 2,5	1,3-11
Y	page 8, line 12 - line 24 ---	2
Y	US 4 467 879 A (BURGE EDWARD V) 28 August 1984 (1984-08-28) column 2, line 27 - line 35; figures 1,4,5 column 6, line 43 -column 7, line 59 ---	2
A	WO 96 28635 A (BRIT BIT LIMITED ;STRONG PHILLIP (GB); WARDLEY MICHAEL (GB)) 19 September 1996 (1996-09-19) claims 1,4,8,15; figures 3,6 ---	1
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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G document member of the same patent family

Date of the actual completion of the international search

28 February 2001

Date of mailing of the international search report

07/03/2001

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INTERNATIONAL SEARCH REPORT

Internal Application No

PCT/GB 00/04704

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

Internat I Application No

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